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Stenoderma rufum.

By Hugh H. Genoways and Robert J. Baker

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Stenoderma É. Geoffroy St.-Hilaire, 1818

Stenoderma É. Geoffroy St.-Hilaire, 1818:122. Type species "le stenoderme roux" (=*Stenoderma rufa* Desmarest, 1820).

Histiops Peters, 1869:399. Type species *Artibaeus undatus* Gervais (=*Stenoderma rufa* Desmarest).

CONTEXT AND CONTENT. Order Chiroptera, Family Phyllostomatidae, Subfamily Stenoderminae. The genus *Stenoderma* contains a single species, *Stenoderma rufum*, as treated below.

Stenoderma rufum Desmarest, 1820

Red Fig-eating Bat

Stenoderma rufa Demarest, 1820:117. Type locality unknown, but specimens from St. John and St. Thomas in the Virgin Islands were considered to be indistinguishable from the holotype by Hall and Tamsitt (1968:3).

Artibaeus undatus Gervais, 1855:35. Type locality unknown.

CONTEXT AND CONTENT. Context noted in generic summary. Three subspecies are recognized as follows:

S. r. rufum Desmarest, 1820:117, see above.

S. r. darioi Hall and Tamsitt, 1968:1. Type locality 1 mi. NW El Yunque Peak, 355 m., Puerto Rico.

S. r. anthonyi Choate and Birney, 1968:407. Type locality Cueva de Clara, approximately ½ mi. N, 3 mi. W Morovis, Barahona District, Puerto Rico (based on material from sub-Recent cave deposit).

DIAGNOSIS. Because the genus is monotypic, the diagnosis given below applies to genus and species. Cranium resembling that of the other Antillean genera *Phyllops*, *Ariteus*, and *Ardops* (figure 1); skull characterized by nasal region much depressed between high supraorbital ridges; braincase domed, with distinct sagittal crest; incisive foramina separated from roots of incisors by space equal to their greatest diameter; inner upper incisor with high slender crown; first and second upper molars with low but distinct metaconule on surface of crown between hypocone and metacone; third molars small. Dental formula, i 2/2, c 1/1, p 2/2, m 3/3, total 32. External characters of the red fig-eating bat include: nose-leaf simple, erect, and lanceolate; pinnae of ears naked and pale to dark brown; flight membranes black to dark brown; interfemoral membrane sparsely haired; proximal two-fifths of forearm and associated portion of patagium well-haired; calcar approximately 3.5 mm long; tail absent (figure 2). Pelage varies from 8 mm long dorsally to 6 mm long on the venter. Upper parts vary in coloration from Buckthorn Brown to Dresden Brown (nomenclature from Ridgway, 1912), paler ventrally; a white spot, 4 mm in diameter, is located where the wing joins the side of the body and a crescent of white (8 mm long) is directed anteriorly below each ear. The above comments are modified from Miller (1907:165–166) and Hall and Bee (1960:72–73).

GENERAL CHARACTERS. Means and extremes (in parentheses) for four external measurements (from Jones *et al.*, 1971:245) for adult males (13 individuals for first three and 14 for last) and adult females (five for first three and six for last) from Puerto Rico were in millimeters, respectively, as follows: total length, 65.5 (60.0 to 73.0), 67.8 (66.0 to 70.0); length of hind foot, 13.4 (12.0 to 15.0), 13.8 (13.0 to 15.0); length of ear, 17.4 (16.0 to 19.0), 17.8 (17.0 to 18.0); length of forearm, 47.5 (46.2 to 48.8), 49.7 (48.9 to 51.0). Cranial measurements, in the same order, for specimens (15 males and seven females) from Puerto Rico (Jones *et al.*, 1971:245) were: greatest length of skull, 22.3 (21.8 to 22.9), 22.9 (22.6 to 23.4); zygomatic breadth, 14.8 (14.4 to 15.4), 15.4 (15.2 to 15.8); postorbital constriction, 5.5 (5.2 to 5.8), 5.7 (5.5 to 6.0); breadth of braincase, 10.7 (10.3 to 11.0), 10.8 (10.5 to 11.3); mastoid breadth, 12.3 (11.8 to 12.7), 12.7 (12.4 to 13.5); length of maxillary toothrow (C–M3), 6.9 (6.7 to 7.2), 7.2 (6.9 to 7.4); breadth across upper molars (M2), 9.7 (9.5 to 9.8), 10.0 (9.8 to 10.2); depth of braincase, 11.9 (11.4 to 12.3), 12.3 (12.0 to 12.8); length of mandible, 13.2 (12.8 to 13.6), 13.9 (13.6 to 14.1); height of coronoid process, 7.7 (7.4 to 7.8), 7.9 (7.7 to 8.0). Additional discussion of characteristics of *Stenoderma* can be found in Peters (1876), Anthony (1918, 1925), and Hall and Bee (1960).

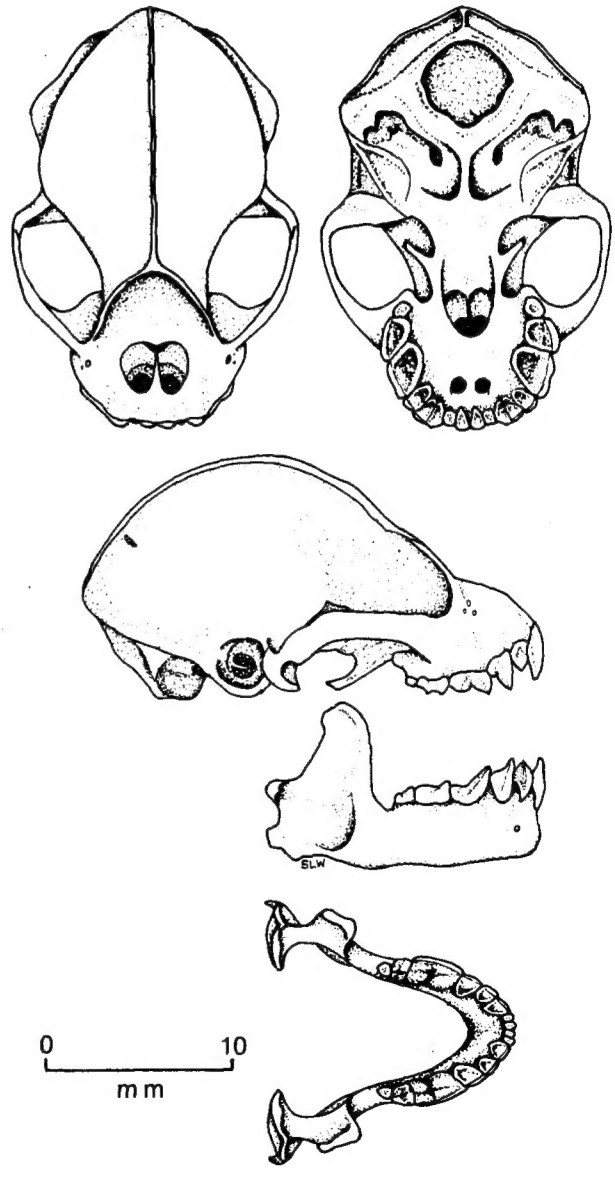

FIGURE 1. Dorsal, ventral, and lateral views of cranium, and lateral and occlusal views of the lower jaw of *Stenoderma rufum*, TTU 8880, female from El Verde Research Station, Luquillo National Forest, Puerto Rico. Drawn by Stephen L. Williams.

FIGURE 2. Face and venter of a subadult male (American Museum of Natural History No. 208982) of *Stenoderma rufum* from 1 mi. NW El Yunque Peak, Puerto Rico. Photograph courtesy of J. R. Tamsitt.

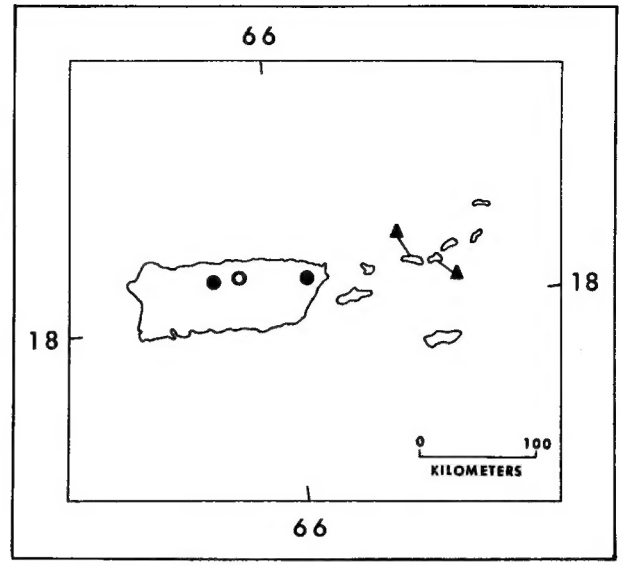

FIGURE 3. Geographic distribution of *Stenoderma rufum* on Puerto Rico and Virgin Islands. Symbols are as follows: triangles, *S. r. rufum*; solid circles, *S. r. darioi*; open circle, *S. r. anthonyi* (sub-Recent fossils).

DISTRIBUTION. Recent specimens of *Stenoderma rufum* have been collected at several places in Luquillo National Forest and at a locality 17.5 km northeast of Utuado on the island of Puerto Rico, and on the Virgin Islands of St. John and St. Thomas (figure 3).

FOSSIL RECORD. Sub-Recent material of *Stenoderma rufum* has been reported (Anthony, 1918, 1925; Choate and Birney, 1968) from three caves—Cueva de Catedral, Cueva de Clara, and Cueva del Perro—in the vicinity of Morovis, Puerto Rico. Choate and Birney (1968:407–408) described this material as a distinct subspecies, *S. r. anthonyi*. They distinguished *anthonyi* from the Recent taxa as follows: larger size; possession of a posteroexternal cingulum on ml that was usually broader, less rounded, and with more pronounced cusp; deeper and narrower depression between trigonid and entoconid of ml; and more or less pronounced accessory cusplet on the posterointernal surface of the entoconid of ml. No other fossil material assignable to this genus is known.

FORM. Jones *et al.* (1971) found marked secondary sexual dimorphism in populations of *Stenoderma rufum* from Puerto Rico. In the four external and 10 cranial measurements listed above, females averaged larger in all and were significantly larger than males in 10 (excepting total length, length of hind foot, length of ear, and breadth of braincase). However, limited material from St. John indicates that this marked dimorphism may not exist on that island. Measurements of immature specimens (those with grayish pelage and unfused or incompletely fused phalangeal epiphyses) were smaller than those of adults in all measurements and significantly so in some (Jones *et al.*, 1971).

Color of dorsum varied from tan to a dark chocolate brown in Puerto Rican specimens. The darkest individuals appeared to be those that had only recently completed molt from juvenile to adult pelage. The St. John specimens are paler than those from Puerto Rico being near Buckthorn Brown instead of Dresden Brown. Of 30 specimens studied from Puerto Rico (Jones *et al.*, 1971), all but one had the complete dental complement of 32 teeth, and none revealed dental caries or loss of teeth in life. One specimen lacked the minute and peglike third lower molar on both sides. Three males examined by Jones *et al.* (1971) lacked a baculum.

The Recent subspecies, *Stenoderma rufum darioi*, of Puerto Rico is distinguished from *S. r. rufum* of St. John and St. Thomas by darker coloration and more marked secondary sexual dimorphism. Also the female examined from St. John is much smaller than females from Puerto Rico, although males from these places are essentially the same size.

No information is available on the post-cranial skeleton or soft anatomy of this species.

FUNCTION. Hematological data for *Stenoderma* were presented by Valdivieso and Tamsitt (1971). They found 20 g of hemoglobin per 100 ml of blood. A white blood cell differential count revealed 57% neutrophils, 29% lymphocytes, 1% eosinophils, 0 basophils, and 5% monocytes. Erythrocyte diameters averaged 5.4μ ranging from 4.5 to 6.8μ. No blood parasites were observed. No other physiological data are available for this species.

ECOLOGY. Live specimens of *Stenoderma rufum* have been taken on three islands, Puerto Rico, St. John, and St. Thomas. Ecological data are available for areas of capture on the former two islands but nothing is published about the condition under which the one known specimen from St. Thomas was obtained. The habitat in which this species was taken on St. John was "a dry arborescent vegetation" (Hall and Bee, 1960). More specifically the three specimens obtained there were collected "among larger trees, at the mouths of canyons, on lowland grazed by domestic stock until 1956, one tenth of a mile from the ocean, on the southern side of the island" (Hall and Bee, 1960). Bat species associated with *Stenoderma* at this locality were *Noctilio leporinus*, *Brachyphylla cavernarum*, *Artibeus jamaicensis*, *Tadarida brasiliensis*, and *Molossus molossus*.

The ecology of the collection site in Luquillo National Forest, Puerto Rico (Hall and Tamsitt, 1968; Jones *et al.*, 1971), has been intensively studied (Odum and Pigeon, 1971). However, little is known concerning how *Stenoderma* interacts in this environment. The forest, which was described in great detail, is a tropical rain forest with a higher annual precipitation than the St. John locality. Specimens of *Stenoderma* have been collected from up to 3 m above paths and streams in the forest (Hall and Tamsitt, 1968; Jones *et al.*, 1971) and from above the canopy of the forest (Jones *et al.*, 1971). Eight species of bats have been reported from Luquillo National Forest (Tamsitt and Valdivieso, 1971; Jones *et al.*, 1971). Three species were frugivorous (*Artibeus jamaicensis*, *Brachyphylla cavernarum*, and *Stenoderma*), two were nectarivorous (*Monophyllus redmani* and *Erophylla bombifrons*), and three were insectivorous (*Eptesicus fuscus*,

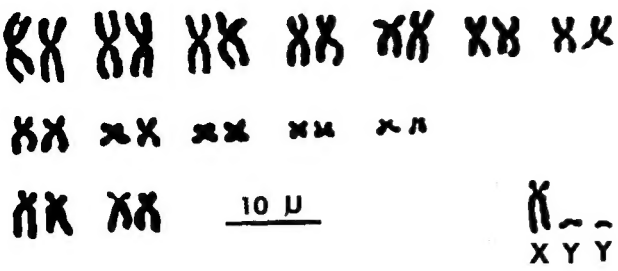

FIGURE 4. Representative karyotype of *Stenoderma rufum darioi*.

Pteronotus parnellii, and *Molossus molossus*). Of the frugivorous species found at this locality, *Artibeus* is the commonest. Mist-netting produced at least two specimens of *Artibeus* for each specimen of *Stenoderma*. Specimens of *Brachyphylla* were taken only above the forest canopy and appeared to be less numerous than the other two species.

No observations on the food habits of *Stenoderma* have been published. One of us (RJB) maintained three specimens alive for 3 weeks on a diet of mangos, various fruit nectars, and bananas. It was necessary to expose the flesh of the fruit before the animals would attempt to eat. They seemed to prefer the overripe portions of mangos.

Ectoparasites of *Stenoderma* have been reported (Tamsitt and Fox, 1970*a*, 1970*b*; Tamsitt and Valdivieso, 1971). The two ectoparasites known to occur on *Stenoderma* are mites (Acarina) of which one is a listrophorid, *Paralabidocarpus artibei* Pinichpongse, and the other a spinturnicid, *Periglischrus inheringi* Oudemans.

REPRODUCTION AND ONTOGENY. Pregnant females of *Stenoderma rufum* have been collected on 3 July (only adult female obtained—Tamsitt and Valdivieso, 1971), from 17 to 20 July (six of 12 adult females collected—Jones *et al.*, 1971) and on 5 August (only adult female obtained—Tamsitt and Valdivieso, 1966). The female obtained on 3 July contained an early implantation (with the greatest diameter of the uterus being 5.1 mm). The seven pregnant females collected from 17 to 20 July and on 5 August all contained embryos that were near full term and two gave birth within 24 hours of capture. Of the six other adult females netted in the period 17 to 20 July, one was lactating and the others showed no apparent signs of reproductive activity. Males obtained in July, August, and February had enlarged scrotal testes with active spermatogenesis (Tamsitt and Valdivieso, 1971).

Parturition of one young was described by Tamsitt and Valdivieso (1966). Birth was by head presentation. At birth the body of the young was well furred, with hairs 2 mm long, but the face was pink and mostly devoid of hair. The eyes were open. One day after birth the young weighed 7 g. Measurements in millimeters of the day-old young followed by those of the female parent were head and body 45, 61; hind foot, 12.1, 13.0; forearm, 29.4, 49.6; and wingspan 201, 385. One of us (RJB) observed parturition in another female and these observations agreed closely with those described by Tamsitt and Valdivieso.

GENETICS. The karyotype of *Stenoderma rufum darioi* is known from 12 males (figure 4) and four females (Baker and Lopez, 1970). The diploid number is 30 (females) and 31 (males) with a fundamental number of 56. The sex determining system is XX/XY_1Y_2 and is similar to that described for *Artibeus jamaicensis* (Hsu *et al.*, 1968). Although one of the most anatomically aberrant species within the subfamily Stenoderminae, *Stenoderma* is similar chromosomally to the more typical stenodermine genus *Artibeus*. It shares with *Artibeus* (*Artibeus phaeotis* excepted) a common diploid number, fundamental number, and the same type of sex determining system. It differs from *Artibeus* by having two less pairs of subtelocentric autosomes (Baker, 1967). From a morphological point of view, two other genera, *Ametrida* and *Centurio*, are more closely related to *Stenoderma* than is *Artibeus*. *Ametrida* has a karyotype with the autosomes similar to *Stenoderma* and an XY_1Y_2 male chromosome system. However, the two Y chromosomes are acrocentric in *Stenoderma* and they are biarmed in *Ametrida* (Baker and Hsu, 1970). The karyotype of *Centurio* is unlike that of either *Artibeus* or *Stenoderma*. *Centurio* has a diploid number of 28, fundamental number of 52, and an XX/XY sex chromosome system. In summary, the chromosomes of *Stenoderma* suggest that it had a common origin with *Artibeus*, *Enchisthenes*, and *Ametrida* (Baker and Lopez, 1970).

The hemoglobin of *S. r. darioi* has been compared electrophoretically with that of other phyllostomatids as well as with representatives of the families Mormoopidae, Vespertilionidae, and Molossidae (Valdivieso *et al.*, 1969; Tamsitt and Valdivieso, 1969). *Stenoderma* possessed a hemoglobin electrophoretic pattern that was indistinguishable from that of other phyllostomatids tested. Each of the other three families exhibited a unique electrophoretic pattern.

REMARKS. Although specimens of *Stenoderma rufum* are rare in scientific collections, the species has had a long and rather confusing taxonomic history. The first reference to the species in the literature was under the name *St*[*enoderma*]. *rufus* Oken (1816). However, Oken's names are not available under the current rules of zoological nomenclature because he was not consistently binary nor consistently binomial (see Hershkovitz, 1949). Therefore the generic name *Stenoderma*, dates from a work on Egypt by É. Geoffroy St.-Hilaire in 1818 (see Hall and Bee, 1960:74, for use of the publication date) and the specific name, *rufum*, first became available under the rules in a work by Desmarest in 1820. The holotype, which was of unknown geographic origin, was the only modern specimen recorded in the scientific literature until the report of Hall and Bee (1960) of specimens from St. John Island. In the intervening years, however, Anthony (1918, 1925) reported sub-Recent cave material from Puerto Rico, confirming speculations by earlier authors (Allen, 1911:238) that the species inhabited the West Indies.

The species was poorly characterized until Peters visited the Paris Museum in 1869, where he studied the holotype as represented by a damaged skin from which the skull had been removed. Peters was deceived by Geoffroy's faulty figure and concluded that *Stenoderma* was *Vampyrops* (Peters, 1869:399). Later, Peters examined the holotype of *Artibeus undatus* Gervais in the anatomical collection of the Paris Museum and was impressed by the similarity between the skull of *undatus* (the holotype of *undatus* was a skull, the skin of which was lost) and the skull figured by Geoffroy. Peters (1876) concluded that the skull of *undatus* was the long lost skull of *Stenoderma rufum* and defined the characteristics of the species, thus ending speculation as to its validity. The above remarks were taken from Anthony (1918, 1925). It should be noted that the skull of the holotype of *Artibeus undatus* could not be located in the Paris Museum in 1958 (Hall and Bee, 1960:69).

Stenoderma is from the Greek words *stenos* and *derma* meaning "narrow skin," which undoubtedly refers to the narrow interfemoral membrane mentioned by Geoffroy in his description of the genus. The specific name, *rufum*, is the Latin word meaning red. The two subspecific names, *darioi* and *anthonyi*, are commemoratives, proposed, respectively, in honor of Darío Valdivieso, for his contributions to neotropical zoology, and H. E. Anthony, for his classical work on the mammals of Puerto Rico.

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The principal editor of this account was S. ANDERSON.

H. H. GENOWAYS, THE MUSEUM, TEXAS TECH UNIVERSITY, LUBBOCK, 79409; R. J. BAKER, DEPARTMENT OF BIOLOGY AND THE MUSEUM, TEXAS TECH UNIVERSITY, LUBBOCK, 79409.